

Remarks

Claims 17--33 are now pending in this application. Claims 1-16 were previously canceled without prejudice. Claims 17 and 20 are hereby amended. No new matter is being added.

Drawings

1. The drawings are objected to because the boundary between layers 6 and 12 in FIG. 1D is not readily visible. Applicants submit herewith five replacement sheets including FIGS. 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, and 1I, as hereby amended. (The amended figures are copies of the originally-filed drawings from the parent application 10/231,356, which was incorporated by reference into the present application. Hence, no new matter is being added.)

As seen in amended FIG. 1D, layer 6 is now shown with diagonal white striping, while layer 12 is shown with a dark solid area without said striping. Hence, applicants respectfully submit that this objection is now satisfied.

2. The drawings are objected to because the reference numeral 24 refers to "filled", "fill", and "sealed" in the specification. Applicants have hereby amended the specification such that reference numeral 24 now refers only to "sealed layer 24". Therefore, applicants respectfully submit that this objection is now satisfied.

Specification

3. The specification is objected to for informalities on page 3 and page 15. Applicants have hereby amended page 3, line 4 so as to insert a space between "of" and "the". Applicants have also hereby amended page 15, line 3, so as to recite "For a SAW device." Hence, applicants respectfully submit that this objection is now satisfied.

Claim Rejections

4. Claims 17, 19-25, and 31-32 stand rejected under 35 USC 102 (e) as being anticipated by Pahl et al (USP 6,931,699). In addition, claims 18, 26-28 and 33 stand rejected under 35 USC 103 (a) as being unpatentable over Pahl et al in view of Onishi et al (USP 6,154,940). Independent claims 17 and 20 are hereby amended. The aforementioned rejections are traversed with respect to the claims as now amended.

Claim 17 now recites as follows.

17. A surface acoustic wave (SAW) device sealed at the wafer level, the device comprising:
 an active area to be protected;
 an electrical contact area; and
 a lithographically-formed structure sealing at least the active area and leaving at least a portion of the electrical contact area exposed,
 wherein the lithographically-formed structure comprises **a seal coating deposited over a sacrificial material**, said sacrificial material being **subsequently removed by etching**.

(Emphasis added.)

As seen above, claim 17 is now limited to a SAW device including “a lithographically-formed structure sealing at least the active area ... wherein the lithographically-formed structure comprises a seal coating deposited over a sacrificial material”

The sacrificial material is disclosed, for example, in FIG. 1B, and the description on page 6, line 19 through page 7, line 2, which are reproduced below for convenience of reference.



FIG. 1B

FIG. 1B is a cross-sectional diagram depicting the structure after the deposition of a sacrificial material 6. In one embodiment, the sacrificial material may be deposited as a (nearly) uniform coating of polysilicon. The use of polysilicon as the sacrificial material 6 has an advantage that the deposition can be used to increase either the bulk or surface conductivity of SAW materials such as lithium niobate or lithium tantalate. This is due to a chemical reduction process that is known to occur when these substrates are heated in vacuum.

The deposition of the seal coating over the sacrificial material is disclosed, for example, in FIG. 1D, and the description on page 9, lines 3-6, which are reproduced below.



FIG. 1D

FIG. 1D is a cross-sectional diagram depicting the structure after deposition of a seal coating 12. The seal coating 12 may be deposited over the entire wafer and may comprise a relatively thick layer of, for example, a glassy material. The glassy material may be, for example, a spin-on-glass or a sputtered glass.

The subsequent etching of the sacrificial material is disclosed, for example, in FIG. 1F, and the description on page 9, line 17, through page 10, line 10, which are reproduced below.

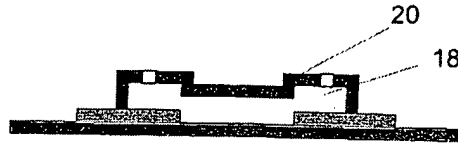


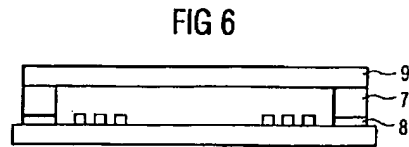
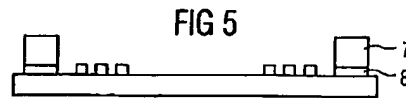
FIG. 1F

FIG. 1F is a cross-sectional diagram depicting the structure after etching away the remaining sacrificial material 10 by way of the via(s) to create a pocket 18 surrounded by a structure 20 of the seal coating. The etching may be done by a dry etching process that does not leave undesirable residue.

For example, in one embodiment, the etching of a polysilicon (or amorphous silicon) sacrificial material on, for example, a lithium tantalate (or lithium niobate) wafer with a sealing layer of silicon dioxide (or silicon nitride or metal) may be accomplished by placing the wafer in a xenon-difluoride atmosphere. The xenon-difluoride enters the vias and attacks the sacrificial material with high selectivity (i.e. leaving the substrate and sealing coating substantially un-etched). The xenon-difluoride also removes the sacrificial material without leaving a substantial residue on the surface of the wafer. Leaving the acoustically active portion of the surface residue free prevents adverse alterations to wave propagation characteristics of the device. A pocket is thereby formed between the seal coating structure 20 and the surface of the wafer in the region previously occupied by the remaining sacrificial material 10. Alternatively, a different gas with similar characteristics to xenon-difluoride may be used to dry etch the sacrificial material.

In contrast, neither Pahl et al nor Onishi et al teach or disclose the above-discussed limitations.

In Pahl et al, the covering layer 9 is supported by a **support frame** comprising resist structure 7 with high-resistance layer 8. This is illustrated in FIGS. 5 and 6 of Pahl et al, which are reproduced below.



Hence, Pahl et al does not teach or disclose the claimed seal coating formed by deposition on a sacrificial material, said sacrificial layer being subsequently removed by etching. Instead, Pahl et al teaches forming the covering layer 9 on top of a support frame (7 and 8).

Similarly, in Onishi et al, the cover 5b is formed on "a rectangular frame-shaped support layer 5a" surrounding "opening 50" (column 5, lines 51-53). This is illustrated in FIGS. 3B and 4B of Onishi et al, which are reproduced below.

Fig.3B

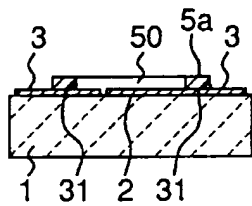
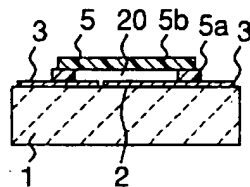


Fig.4B



Hence, Onishi et al does not teach or disclose the claimed seal coating formed by deposition on a sacrificial material, said sacrificial layer being subsequently removed by etching. Instead, Onishi et al teaches forming the cover 5b on top of a frame-shaped support layer 5a.

For at least the above-discussed reasons, applicants respectfully submit that claim 17 is now patentably distinguished over the cited art.

Claims 18-19 and 25-33 depend from claim 17. As such, applicants respectfully submit that claims 18-19 and 25-33 are now patentably distinguished over the cited art for at least the same reasons as discussed above in relation to claim 17.

Similar to claim 17, claim 20 is hereby amended and now recites that “said wafer-level means for sealing comprises **a seal coating deposited over a sacrificial material**, said sacrificial material being **subsequently removed by etching**.” Therefore, applicants respectfully submit that claim 20 is now patentably distinguished over the cited art for at least the same reasons as discussed above in relation to claim 17.

Claims 21-24 depend from claim 20. Hence, applicants respectfully submit that claims 21-24 are now patentably distinguished over the cited art for at least the same reasons as discussed above in relation to claim 20.

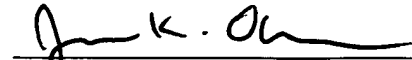
Conclusion

Favorable action is respectfully requested. The examiner is also invited to call the below-referenced attorney to discuss this case.

Respectfully Submitted,

Dated: May 22, 2006

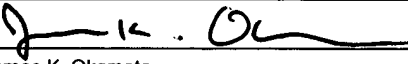
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Amendment to the Drawings

Please substitute amended FIGS. 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, and 1I on five replacement sheets enclosed herewith for originally-filed FIGS. 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, and 1I.